

The puzzle of low power FRII

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A large sample of FRI

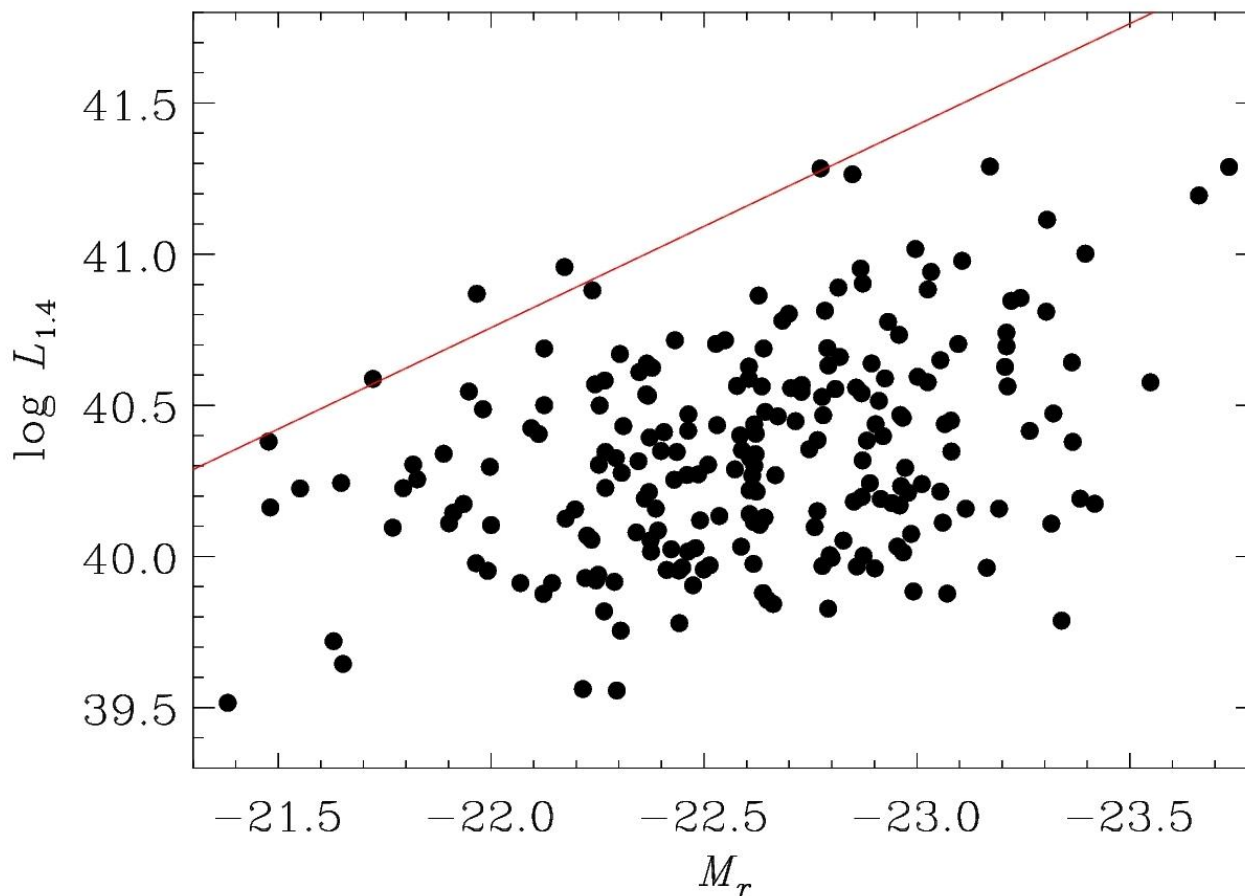
We built a sample of 219 FR I from FIRST; $z < 0.15$
and l.a.s. > 30 kpc

We adopt strict criteria for a positive
classification of these edge darkened sources

The FR I hosts are red massive ellipticals with
large black holes and this is well known...

FR I are all located below the dividing line in the P – M (radio-optical) plane (Ledlow & Owen, 1996). **Jets know about the host.**

Brighter galaxies have denser and more extended ISM and the jets are more easily disrupted.

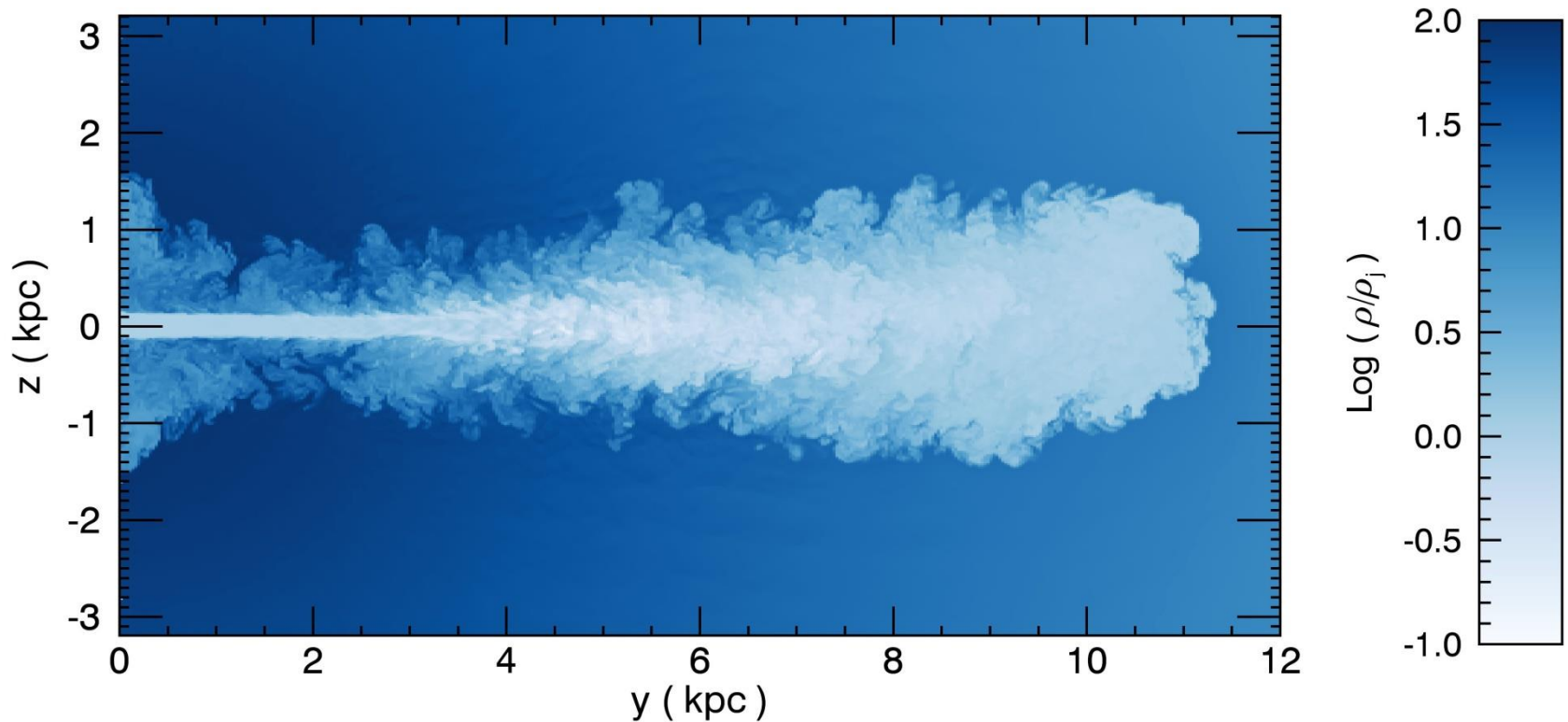


Numerical experiments

We follow the evolution of a low power jet in a stratified medium

$P_{\text{jet}} = 10^{42}$ erg/s, 10 times below the FRI/II transition, Mach number = 4, density ratio = 100

In high resolution, 3D simulations, the jet disrupts and it does not form a terminal shock \rightarrow FRI morphology.

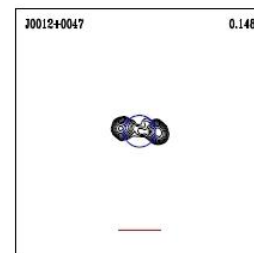
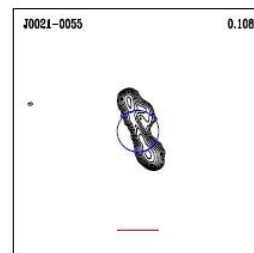
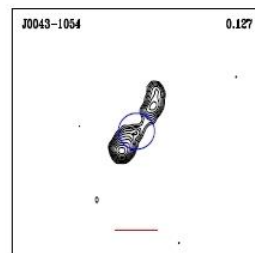
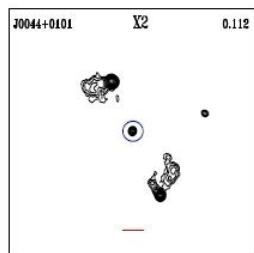
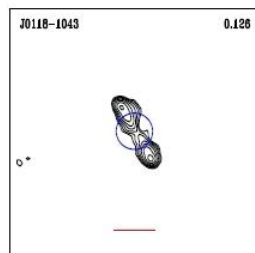
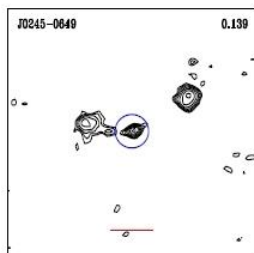
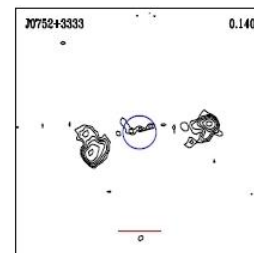
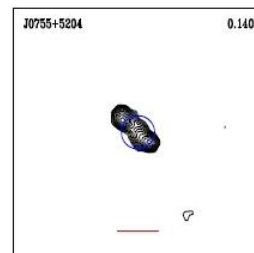
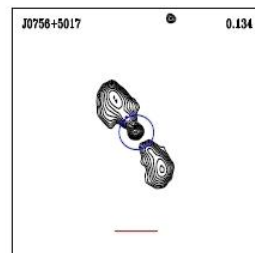
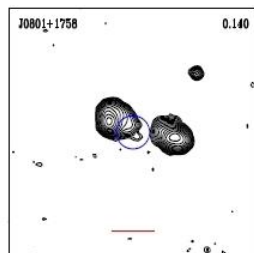
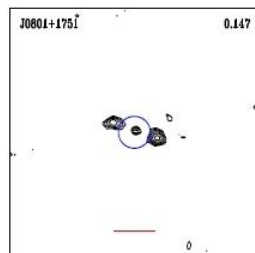
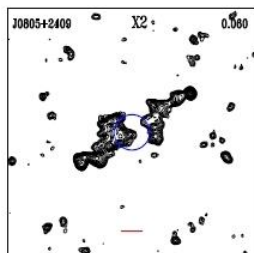
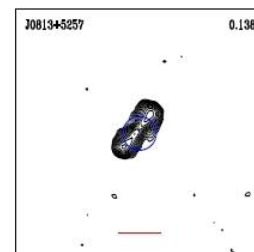
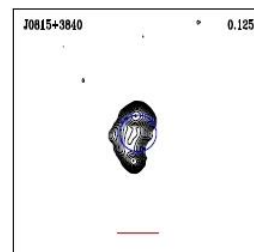
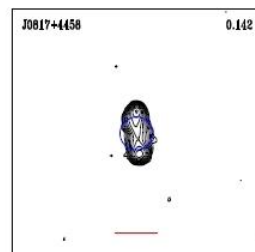
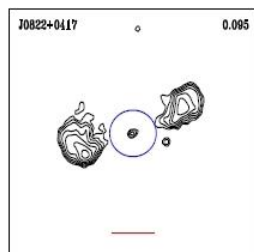
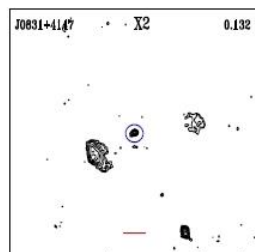
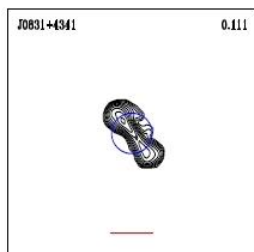
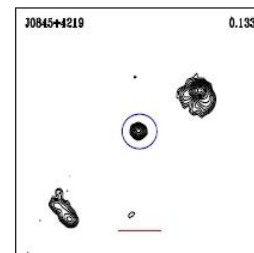
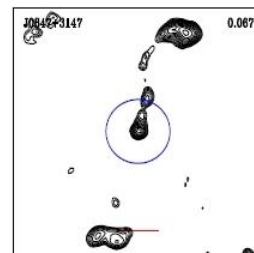
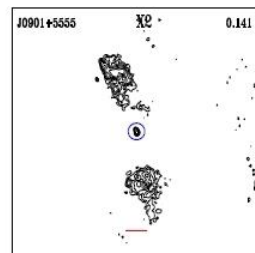
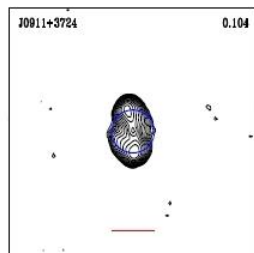
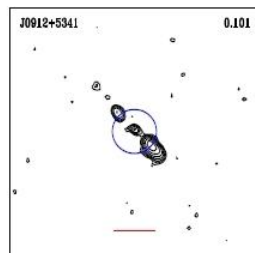
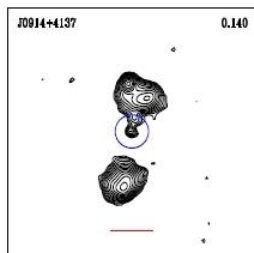


More powerful jets or in less dense ISM produce FR II (roughly) reproducing the PM plane

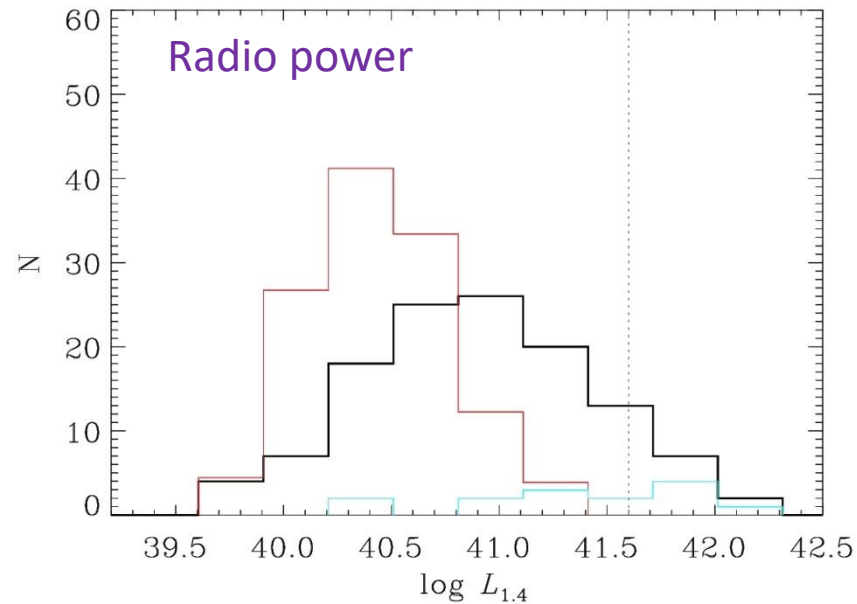
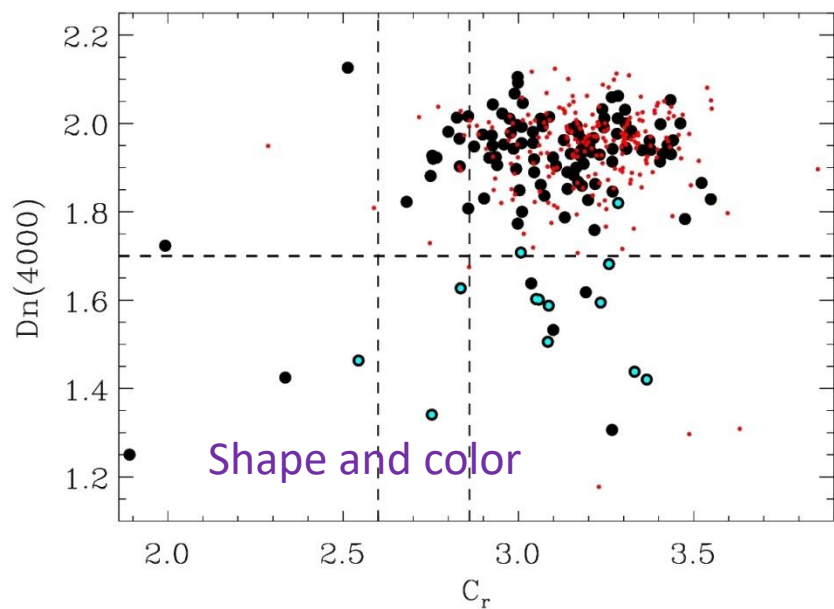
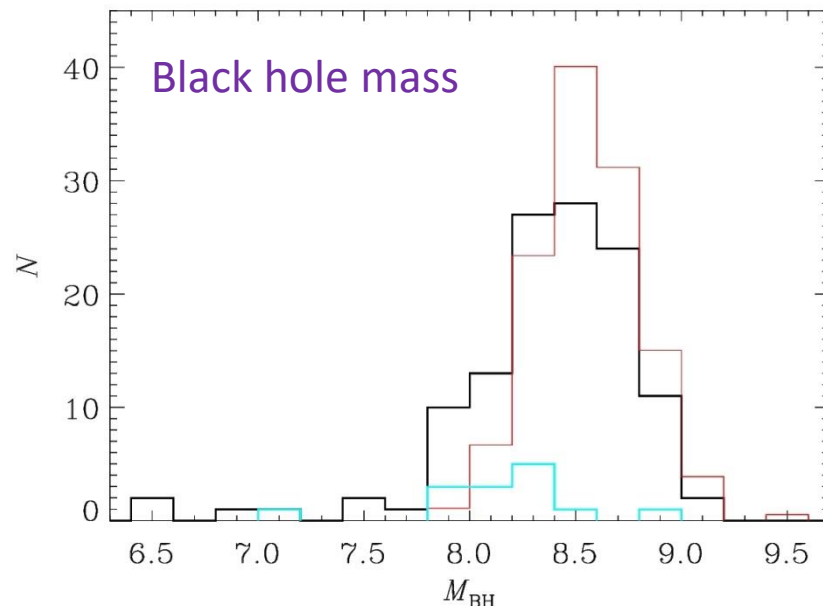
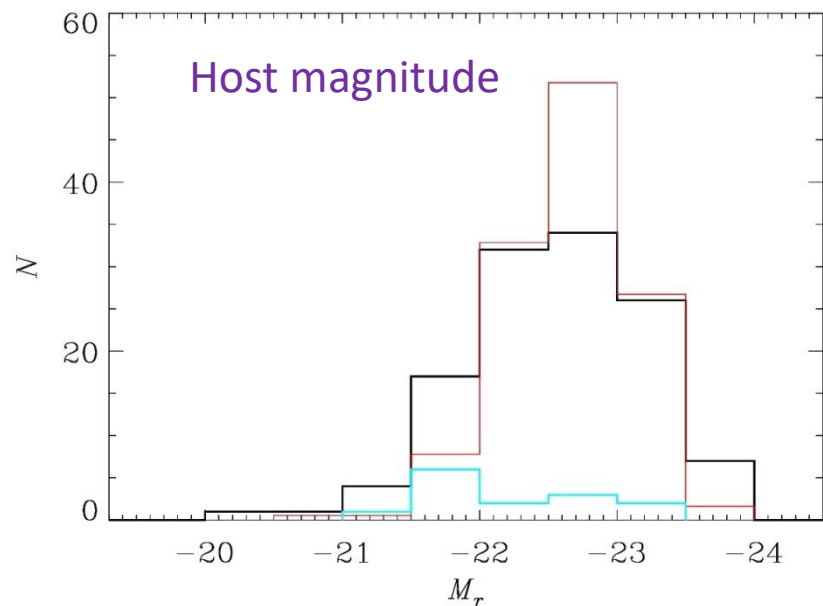
A sample of FR II

A sample of 113 edge brightened FR II from FIRST; $z < 0.15$, at least one peak at $r > 30$ kpc

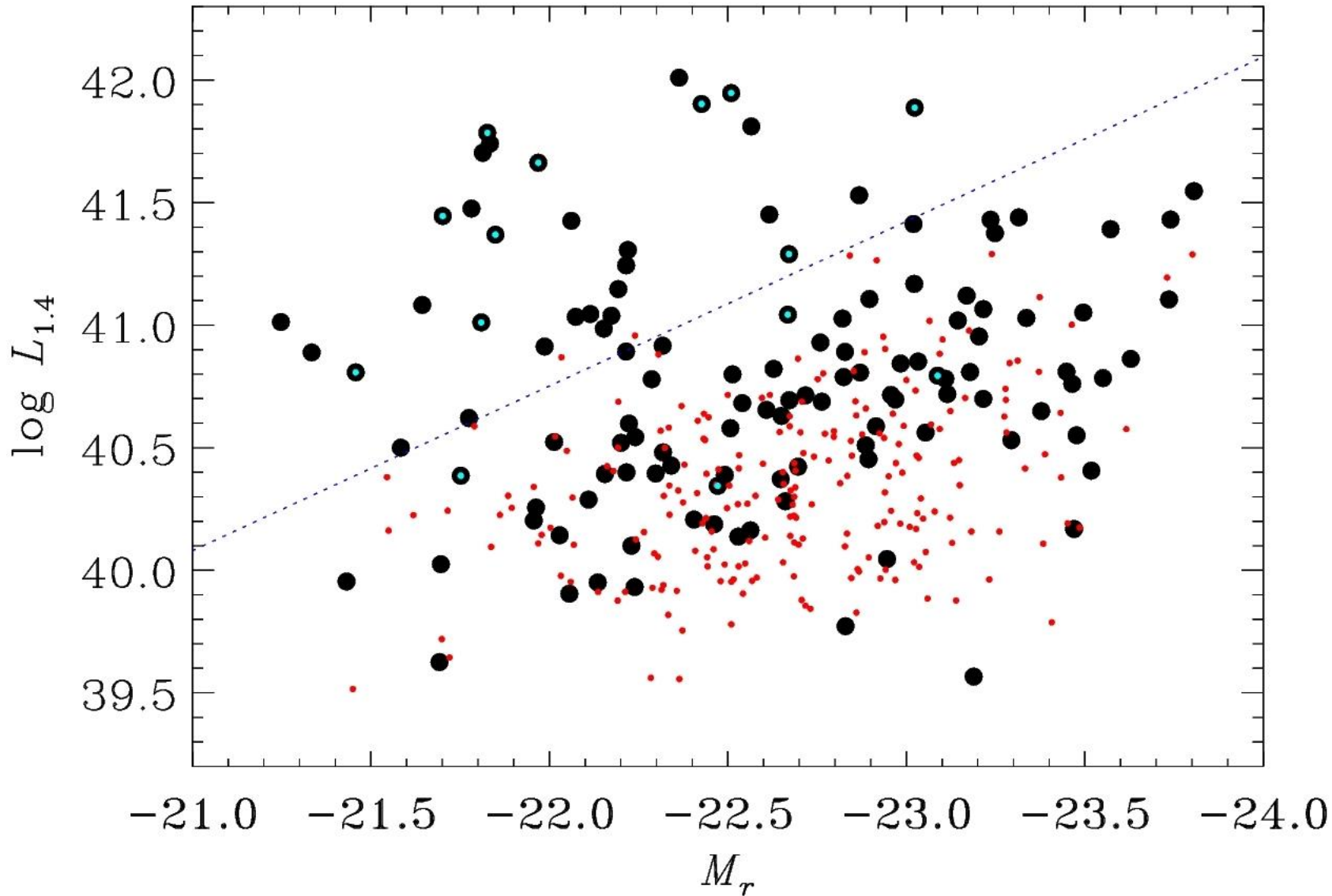
Most of them are LEG (all but 14 HEG)



Comparison between FRI and FRII (LEG and HEG)



The P – M plane for FR II and FRI

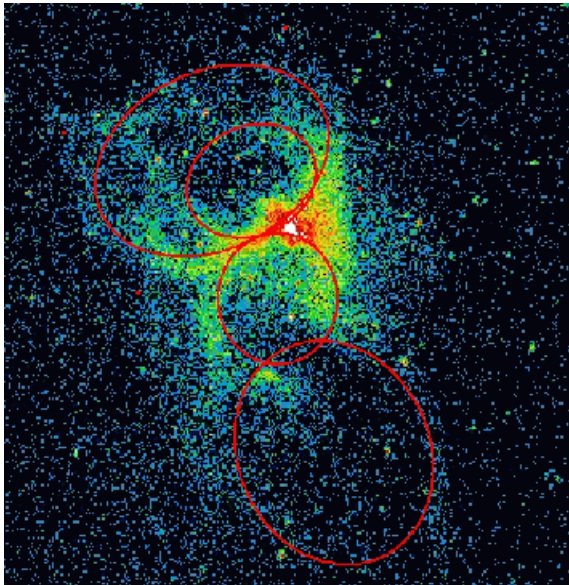


The puzzle of low power FR II

Hyp.: 1) the radio power is a good predictor of the jet power,
2) the ISM is completely defined by the observed host properties

Jets of similar (low) power propagate in the same ISM and produce both FRI and FR II.

This is puzzling... but...

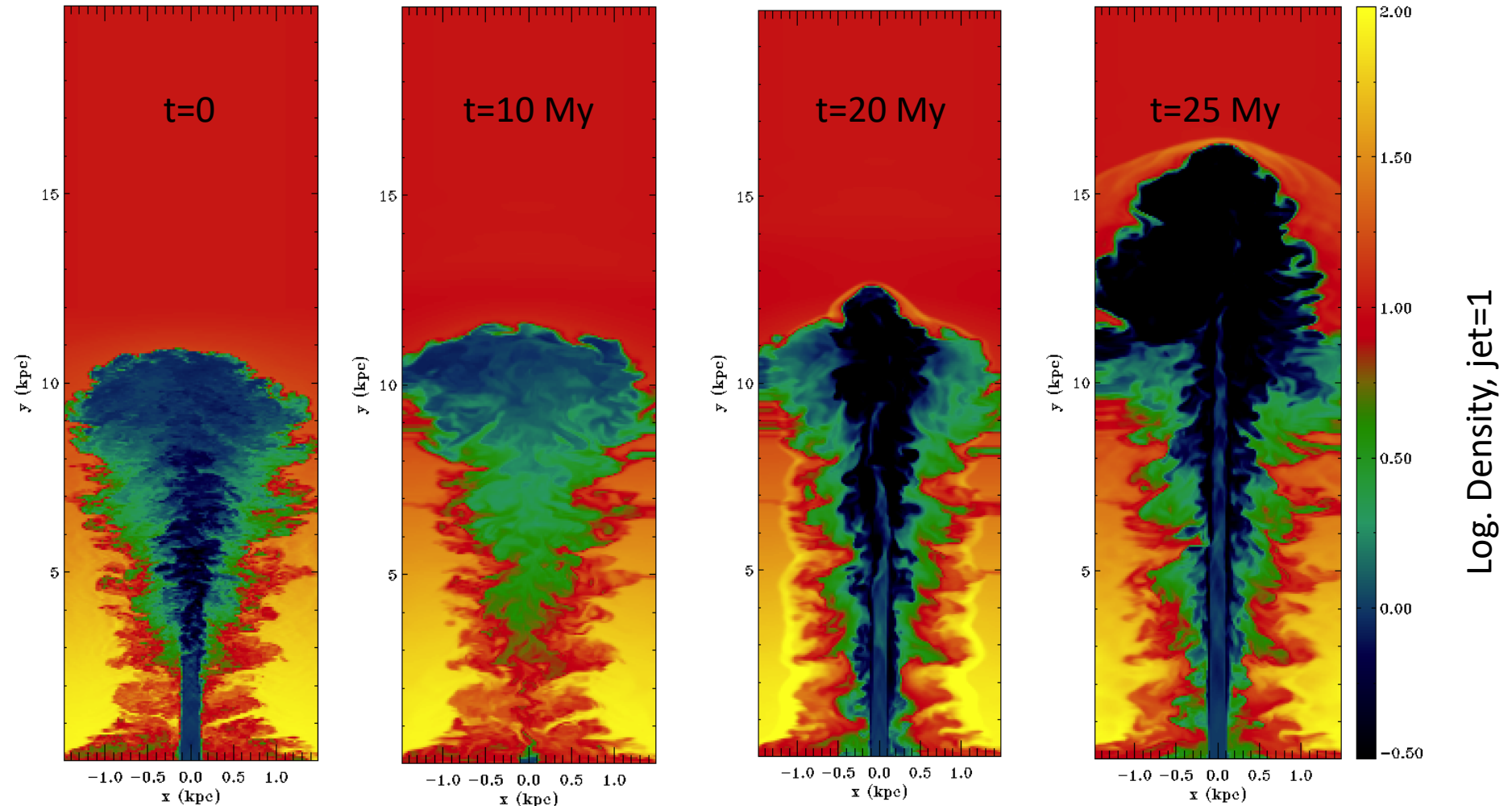


FRI form cavities in the ISM (see e.g. 3C 272.1, aka M84).

Evolution of a low power source in a cavity?

Evolution of a FRI radio source that dies (1), remains quiescent (2), restarts with the same jet power (3), and forms an FRII (4).

The lower external density increases the advance speed and reduces the instabilities.



The cavity must live longer than the time of quiescence. Buoyancy forces set the timescale, order of 10^7 yrs.

Many cavities should be seen, probably “ghosts” (no radio) cavities.

Constraints on activity and recurrence timescales, to be checked against radio relic population.